Introduction to GraphQL

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  - Multiple requests to fetch object graphs
- Multiple views of the same REST endpoint
  - Compact vs full views
- API evolution via versioned endpoints
- Weakly-typed endpoints

REST issues

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- Over-fetching superfluous data
- Multiple requests to materialize resource graphs
  - Client is responsible for orchestrating data fetching
- Payloads tend to grow over time, resulting in over-fetching
- Code duplication when supporting multiple versions

GraphQL Principles

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- Backwards compatible
- Application-layer protocol
- Strongly-typed
- Introspective

Declarative Data Fetching

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- Query language to satisfy data requirements for the client
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- Data requirements are specified as a hierarchy of fields
- Avoid calling multiple endpoints
- Avoid aggregating data manually
- Avoid over-fetching and under-fetching data

Developer Experience

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  - a self describing API which can be introspected by tooling
  - query and mutation input validation
  - query facilities that aggregate data on the server-side

Performance Improvements

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  - reducing the number of requests for a data graph
  - aggregating the data graph on the server-side
  - only sending the data fields requested

Schema Definition Language (SDL)

- Strong type system

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- Type language: Schema Definition Language (SDL)

User-defined Scalars

```
scalar uuid

scalar timestamp

scalar secureUrl
```

Enumerations

```
enum ConflictAction {
  ignore
  update
}
```

Object Types and Fields

```
type Actor {
  id: uuid!
  firstName: String!
  lastName: String!
}
```

User-defined Object Type Field

```
type ActorAggregateFields {
  count(columns: [ActorSelectColumn!],
        distinct: Boolean): Int
  max: ActorMaxFields
  min: ActorMinFields
}
```

Lists and Non-null

```
type ActorsAggregate {
  aggregate: ActorAggregateFields
  nodes: [Actor!]!
}
```

Interfaces

```
interface Person {
  id: ID!
  firstName: String!
  lastName: String!
}

type DraftProspect implements Person {
  id: ID!
  firstName: String!
  lastName: String!
  position: FootballPosition!
}
```

Union

```
union SearchResult = Human | Droid | Starship
```

Input Types

```
input ReviewInput {
  stars: Int!
  commentary: String
}
```

GraphQL Queries

- Queries retrieve data

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- Query structure mimics data structure in response

Query type

```
type Query {
  hero(episode: Episode): Character
  droid(id: ID!): Droid
}
```

Query example

```
query {
  hero {
    name
  }
  droid(id: "2000") {
    name
  }
}
```

GraphQL Mutations

- Mutations create, update, or remove data

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- Typically use input types for specifying a grouping of fields

Mutation type

```
type Mutation {
  addBook(input: AddBookInput!): Book
  removeBook(id: ID!): Boolean
}
```

Mutation example

```
mutation AddBook($input: AddBookInput!) {
  addBook(input: $input) {
    id
  }
}
```

- Input is bound to variables in client

GraphQL Subscriptions

- Server-sent events

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- Server-sent events
- Asynchronous
- Communication through WebSockets
- Server-side implementation dependent on platform

Subscription type

```
type Subscription {
  commentAdded(input: CommentAddedSubscribeInput!): Comment
}
```

Subscription type

```
subscription CommentAddedSubscription(
    $input: CommentAddedSubscribeInput!
  ) {
  commentAddedSubscribe(input: $input) {
    comment {
      id
      commentText
      commenter {id, firstName, lastName}
    }
  }
}
```

Schema declaration

```
schema {
  query: Query
  mutation: Mutation
  subscription: Subscription
}
```

Literature Cited

- https://reactjs.org/blog/2015/05/01/graphql-introduction.html
- https://www.upwork.com/hiring/development/why-facebooks-graphql-language-should-be-on-your-radar/
- https://www.youtube.com/watch?v=pJamhW2xPYw&amp=&feature
- https://speakerdeck.com/dschafer/graphql-client-driven-development?slide=61

Literature Cited

- https://crystallize.com/blog/better-developer-experience-with-graphql
- https://graphql.org/blog/subscriptions-in-graphql-and-relay/